



WORKSHEET

The Normal Distribution Question – Type 2

Question Description: *In this question type they mix binomial and normal distribution to form questions. You will see that they do this most of the time by making you approximate the binomial distribution with the normal distribution.*

QUESTIONS

1 s15_p61

- (i) In a certain country, 68% of households have a printer. Find the probability that, in a random sample of 8 households, 5, 6 or 7 households have a printer. [4]
- (ii) Use an approximation to find the probability that, in a random sample of 500 households, more than 337 households have a printer. [5]
- (iii) Justify your use of the approximation in part (ii). [1]

2 s16_p61

Plastic drinking straws are manufactured to fit into drinks cartons which have a hole in the top. A straw fits into the hole if the diameter of the straw is less than 3 mm. The diameters of the straws have a normal distribution with mean 2.6 mm and standard deviation 0.25 mm.

- (i) A straw is chosen at random. Find the probability that it fits into the hole in a drinks carton. [3]
- (ii) 500 straws are chosen at random. Use a suitable approximation to find the probability that at least 480 straws fit into the holes in drinks cartons. [5]
- (iii) Justify the use of your approximation [1]

3 w18_p61

At the Nonland Business College, all students sit an accountancy examination at the end of their first year of study. On average, 80% of the students pass this examination.

- (i) A random sample of 9 students who will take this examination is chosen. Find the probability that at most 6 of these students will pass the examination. [3]
- (ii) A random sample of 200 students who will take this examination is chosen. Use a suitable approximate distribution to find the probability that more than 166 of them will pass the examination. [5]
- (iii) Justify the use of your approximate distribution in part (ii). [1]

4 s16_p62

When visiting the dentist the probability of waiting less than 5 minutes is 0.16, and the probability of waiting less than 10 minutes is 0.88.

- (i) Find the probability of waiting between 5 and 10 minutes. [1]

A random sample of 180 people who visit the dentist is chosen.

- (ii) Use a suitable approximation to find the probability that more than 115 of these people wait between 5 and 10 minutes. [5]

5 w17_p62

Blank CDs are packed in boxes of 30. The probability that a blank CD is faulty is 0.04. A box is rejected if more than 2 of the blank CDs are faulty.

- (i) Find the probability that a box is rejected. [3]
- (ii) 280 boxes are chosen randomly. Use an approximation to find the probability that at least 30 of these boxes are rejected. [5]

6 s18_p61

In Pelmerdon 22% of families own a dishwasher.

- (i) Find the probability that, of 15 families chosen at random from Pelmerdon, between 4 and 6 inclusive own a dishwasher. [3]
- (ii) A random sample of 145 families from Pelmerdon is chosen. Use a suitable approximation to find the probability that more than 26 families own a dishwasher. [5]

7 s18_p63

The diameters of apples in an orchard have a normal distribution with mean 5.7 cm and standard deviation 0.8 cm. Apples with diameters between 4.1 cm and 5 cm can be used as toffee apples.

- (i) Find the probability that an apple selected at random can be used as a toffee apple. [3]
- (ii) 250 apples are chosen at random. Use a suitable approximation to find the probability that fewer than 50 can be used as toffee apples. [5]

8 w19_p63

A competition is taking place between two choirs, the Notes and the Classics. There is a large audience for the competition.

- 30% of the audience are Notes supporters.
 - 45% of the audience are Classics supporters.
 - The rest of the audience are not supporters of either of these choirs.
 - No one in the audience supports both of these choirs.
- (i) A random sample of 6 people is chosen from the audience.
 - (a) Find the probability that no more than 2 of the 6 people are Notes supporters. [3]
 - (b) Find the probability that none of the 6 people support either of these choirs. [2]
 - (ii) A random sample of 240 people is chosen from the audience. Use a suitable approximation to find the probability that fewer than 50 do not support either of the choirs. [5]

9 s19_p61

In a certain country the probability that a child owns a bicycle is 0.65.

- (i) A random sample of 15 children from this country is chosen. Find the probability that more than 12 own a bicycle. [3]
- (ii) A random sample of 250 children from this country is chosen. Use a suitable approximation to find the probability that fewer than 179 own a bicycle. [4]

10 w19_p62

In Quarendon, 66% of households are satisfied with the speed of their wifi connection.

- (i) Find the probability that, out of 10 households chosen at random in Quarendon, at least 8 are satisfied with the speed of their wifi connection. [3]
- (ii) A random sample of 150 households in Quarendon is chosen. Use a suitable approximation to find the probability that more than 84 are satisfied with the speed of their wifi connection. [5]

11 s17_p63

The probability that George goes swimming on any day is $\frac{1}{3}$. Use an approximation to calculate the probability that in 270 days George goes swimming at least 100 times. [5]

12 s16_p63

Passengers are travelling to Picton by minibus. The probability that each passenger carries a backpack is 0.65, independently of other passengers. Each minibus has seats for 12 passengers.

- (iii) Find the probability that, of a random sample of 250 full minibuses travelling to Picton, more than 54 will contain exactly 7 passengers carrying backpacks. [6]

13 s15_p63

The heights of books in a library, in cm, have a normal distribution with mean 21.7 and standard deviation 6.5. A book with a height of more than 29 cm is classified as 'large'.

- (i) Find the probability that, of 8 books chosen at random, fewer than 2 books are classified as large. [6]

14 w18_p63

The weights of apples sold by a store can be modelled by a normal distribution with mean 120 grams and standard deviation 24 grams. Apples weighing less than 90 grams are graded as 'small'; apples weighing more than 140 grams are graded as 'large'; the remainder are graded as 'medium'.

- (i) Show that the probability that an apple chosen at random is graded as medium is 0.692, correct to 3 significant figures. [4]
- (ii) Four apples are chosen at random. Find the probability that at least two are graded as medium. [4]

ANSWERS

$$\textcircled{1} \text{(i)} \quad p = 0.68 \quad q = 0.32 \quad n = 8$$

$$\begin{aligned} P(5, 6, 7) &= \binom{8}{5} (0.68)^5 (0.32)^3 + \\ &\quad \binom{8}{6} (0.68)^6 (0.32)^2 + \\ &\quad \binom{8}{7} (0.68)^7 (0.32)^1 \\ &= 0.722 \end{aligned}$$

$$\therefore \boxed{P(5, 6, 7) = 0.722}$$

$$\begin{aligned} \text{(ii)} \quad n &= 500 \quad \mu = np = (500)(0.68) = 340 \\ \sigma^2 &= npq = (500)(0.68)(0.32) = 108.8 \end{aligned}$$

$$\therefore X \sim N(340, 108.8)$$

$$P(X > 337) = ?$$

$$P(X > 337) = \underbrace{P(X > 337.5)}$$

Better approximation



$$Z = \frac{337.5 - 340}{\sqrt{108.8}} = -0.2397$$

$$\begin{aligned} \therefore P(X > 337.5) &= P(Z < -0.2397) \\ &= 1 - P(Z < 0.2397) \\ &= 1 - \Phi(0.2397) \\ &= 0.595 \end{aligned}$$

$$\therefore \boxed{P(X > 337) = 0.595}$$

(iii) We can use a Normal apx for the binomial Distribution as:

$$np = 340 > 5 \quad \text{and} \quad npq = 108.8 > 5$$

② $x \sim N(2.6, 0.25^2)$ $x = \text{Diameter of random straw}$

(i) $P(\text{fits}) = P(x < 3)$

$$z = \frac{3 - 2.6}{0.25} = 1.6$$

$$\begin{aligned}\therefore P(x < 3) &= P(z < 1.6) \\ &= \Phi(1.6) = 0.9452\end{aligned}$$

$$\therefore \boxed{P(\text{fits}) = 0.945}$$

(ii) $n = 500$ $p = P(\text{fits}) = 0.945$
 $q = 1 - 0.945 = 0.055$

$X = \# \text{ of randomly selected straws that fit}$

$$X \sim B(500, 0.9452)$$

$$\mu = np = 472.6$$

$$\sigma^2 = npq = 25.898$$

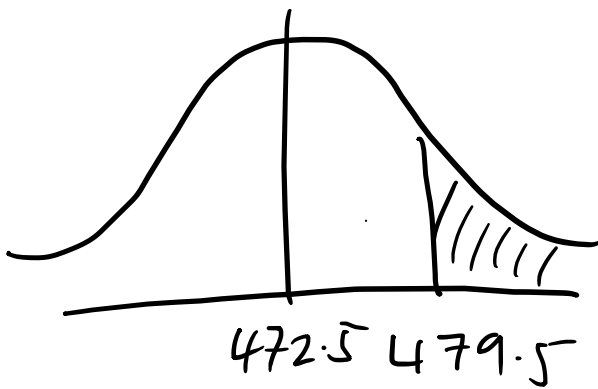
∴ Normal apsr x for X is :

$$X \sim N(472.6, 25.898)$$

$$P(\text{at least } 480) = P(X \geq 480)$$

$$P(X \geq 480) = \underbrace{P(X \geq 479.5)}$$

Better approximation.



$$Z = \frac{479.5 - 472.6}{\sqrt{25.898}}$$

$$\therefore Z = 1.356$$

$$\begin{aligned} \therefore P(Z > 1.356) &= 1 - \Phi(1.356) \\ &= 1 - 0.9125 \\ &= 0.0875 \end{aligned}$$

$$\boxed{P(X \geq 480) = 0.0875}$$

(iii) As $np > 5$ & $npq > 5$

$$(3) P(\text{pass}) = 0.8$$

(i) $X = \#$ of students who pass $p = 0.8$ $n = 9$
 $q = 0.2$

$$P(X \leq 6) = 1 - P(X > 6) \\ = 1 - [P(X=7) + P(X=8) + P(X=9)]$$

$$\therefore P(X \leq 6) = 1 - \left[\binom{9}{7} (0.8)^7 (0.2)^2 + \binom{9}{8} (0.8)^8 (0.2) + \binom{9}{9} (0.8)^9 (0.2)^0 \right]$$

$$\therefore \boxed{P(X \leq 6) = 0.262}$$

$$(ii) \quad n = 200 \quad P(X > 166) = ?$$

$$\mu = np = 200 \times 0.8 = 160$$

$$\sigma^2 = npq = 200 \times 0.8 \times 0.2 = 32$$

$$\therefore X \sim N(160, 32)$$

$$P(X > 166) = \underbrace{P(X > 166.5)}_{\text{better approx.}}$$

$$Z = \frac{166.5 - 160}{\sqrt{32}} = 1.149$$

$$\begin{aligned} \therefore P(X > 166.5) &= P(Z > 1.149) \\ &= 1 - \Phi(1.149) \\ &= 1 - 0.8747 \\ &= 0.1253 \end{aligned}$$

$$\therefore \boxed{P(X > 166) = 0.125}$$

(ii) As $np > 5$ & $npq > 5$

(4) $P(\text{less than } 5) = 0.16$
 $P(\text{less than } 10) = 0.88$

(i) $P(\text{Between } 5 \frac{1}{2} \text{ to } 10) = 0.88 - 0.16$
 $= 0.72$

(ii) $n = 180$ probability of success is
the probability someone
waits between $5 \frac{1}{2}$ to 10 mins.

$\therefore p = 0.72$
 $q = 0.28$ $X \sim B(180, 0.72)$

$\mu = np = 129.6$ $\sigma^2 = npq = 36.288$

$\therefore$ NORMAL APRX OF X :

$X \sim N(129.6, 36.288)$

$$P(X > 115) = \underbrace{P(X > 115.5)}_{\text{BETTER APPROX.}}$$

$$\therefore \bar{z} = \frac{115.5 - 129.6}{\sqrt{36.288}}$$

$$\bar{z} = -2.341$$

$$\therefore P(\bar{z} > -2.341) = 1 - \Phi(2.341) \\ = 0.990$$

$$\therefore \boxed{P(X > 115) = 0.990}$$

$$\textcircled{5} \quad p(\text{faulty}) = 0.04 \quad X = \# \text{ of faulty CD's.}$$

$$\textcircled{i} \quad n = 30 \quad p = 0.04 \\ q = 0.96$$

$$p(\text{Rejected}) = p(X > 2) = 1 - p(X \leq 2)$$

$$\begin{aligned} \therefore p(X > 2) &= 1 - [p(X=0) + p(X=1) + p(X=2)] \\ &= 1 - \left[\binom{30}{0} (0.04)^0 (0.96)^{30} + \right. \\ &\quad \left. \binom{30}{1} (0.04)^1 (0.96)^{29} + \right. \\ &\quad \left. \binom{30}{2} (0.04)^2 (0.96)^{28} \right] \\ &= 0.1169 \end{aligned}$$

$$\therefore \boxed{p(\text{Rejected}) = 0.117}$$

(ii) $n = 280$ $Y = \#$ of boxes rejected.

$$p(\text{Rejected}) = 0.1169$$

$$p = 0.1169$$

$$q = 0.8831$$

$$\therefore Y \sim B(280, 0.117)$$

$$\mu = np = 32.73$$

$$\sigma^2 = npq = 28.9$$

$\therefore$ NORMAL APRX FOR Y :

$$Y \sim N(32.73, 28.9)$$

$$P(Y \geq 30) = \underbrace{P(Y \geq 29.5)}_{\text{BETTER APRX.}}$$

$$\bar{Z} = \frac{29.5 - 32.73}{\sqrt{28.9}}$$

$$\bar{Z} = -0.6008$$

$$\begin{aligned}\therefore P(Y > 29.5) &= P(Z > -0.6008) \\ &= 1 - \Phi(0.6008) \\ &= 0.726\end{aligned}$$

$$\therefore \boxed{P(Y \geq 30) = 0.726}$$

$$\textcircled{6} \quad P(\text{Dishwasher}) = 0.22$$

$$(i) \quad n = 15 \quad p = 0.22 \quad X = \# \text{ of families that own dishwasher}$$
$$q = 0.78$$

$$\begin{aligned} P(4 \leq X \leq 6) &= P(X=4) + P(X=5) + P(X=6) \\ &= \binom{15}{4} (0.22)^4 (0.78)^{11} + \\ &\quad \binom{15}{5} (0.22)^5 (0.78)^{10} + \\ &\quad \binom{15}{6} (0.22)^6 (0.78)^9 \end{aligned}$$

$$\therefore \boxed{P(4 \leq X \leq 6) = 0.398}$$

$$(ii) \quad n = 145 \quad p = 0.22$$
$$q = 0.78$$

$$\therefore X \sim B(145, 0.22)$$

$$\mu = np = 31.9$$

$$\sigma^2 = npq = 24.882$$

∴ NORMAL APRX FOR X :

$$X \sim N(31.9, 24.882)$$

$$P(X > 26) = \underbrace{P(X > 26.5)}_{\text{Better Aprx.}}$$

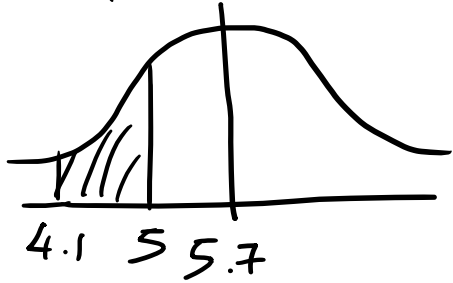
$$\therefore Z = \frac{26.5 - 31.9}{\sqrt{28.882}} = -1.0826$$

$$\begin{aligned} P(Z > -1.0826) &= P(Z < 1.0826) \\ &= \Phi(1.0826) \\ &= 0.861 \end{aligned}$$

$$\therefore \boxed{P(X > 26) = 0.861}$$

$$(7) \quad X \sim N(5.7, 0.8^2)$$

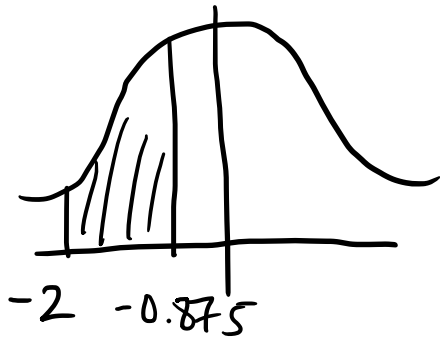
$$(i) \quad p(\text{toffee}) = P(4.1 < X < 5)$$



$$z_1 = \frac{4.1 - 5.7}{0.8} = -2$$

$$z_2 = \frac{5 - 5.7}{0.8} = -0.875$$

$$\therefore P(4.1 < X < 5) = P(-2 < Z < -0.875)$$



$$\begin{aligned} \therefore P(-2 < Z < -0.875) &= P(Z < -0.875) - P(Z < -2) \\ &= P(Z > 0.875) - P(Z > 2) \\ &= (1 - P(Z < 0.875)) - (1 - P(Z < 2)) \\ &= P(Z < 2) - P(Z < 0.875) \\ &= \Phi(2) - \Phi(0.875) \\ &= 0.9772 - 0.8092 = 0.168 \end{aligned}$$

$$\therefore \boxed{P(4.1 < X < 5) = 0.168}$$

(ii) $n=250$ probability of success is
the probability a randomly
selected apple can be used as
a toffee apple.

$$\therefore p = p(\text{toffee}) = P(4.1 < X < 5) = 0.168$$

$$\therefore p = 0.168 \quad \therefore X \sim B(250, 0.168)$$
$$q = 0.832$$

$$P(X < 50) = ?$$

$$\mu = np = 42 \quad \sigma^2 = npq = 34.944$$

$\therefore$ NORMAL APX FOR X :

$$X \sim N(42, 34.944)$$

$$\therefore P(X < 50) = \underbrace{P(X < 49.5)}_{\text{Better apx}}$$

$$\therefore Z = \frac{49.5 - 42}{\sqrt{34.944}} = 1.2687$$

$$\therefore P(Z < 1.2687) = \Phi(1.2687) = 0.898$$

$$\therefore \boxed{P(X < 50) = 0.898}$$

$$\textcircled{8} \text{ (i) } n = 6$$

$$(a) \quad X = \begin{array}{c} \text{\# of Notes} \\ \text{Supporters} \end{array} \quad P(X \leq 2) = ?$$

$$p = 0.30$$

$$q = 0.70$$

$$\begin{aligned} \therefore P(X \leq 2) &= P(X=0) + P(X=1) + P(X=2) \\ &= \binom{6}{0} (0.3)^0 (0.7)^6 + \\ &\quad \binom{6}{1} (0.3)^1 (0.7)^5 + \\ &\quad \binom{6}{2} (0.3)^2 (0.7)^4 \end{aligned}$$

$$\therefore \boxed{P(X \leq 2) = 0.744}$$

$$(b) P(\text{neither}) = 1 - 0.45 - 0.30 = 0.25$$

$$\therefore p = 0.25 \quad X = \# \text{ of that are not supporters of either.}$$
$$q = 0.75$$

$P(X=6)$ = Probability that all of the 6 are not supporters

$$\therefore P(X=6) = \binom{6}{6} (0.25)^6 (0.75)^0$$
$$= 0.25^6 = 0.000244$$

$$\boxed{P(X=6) = 0.000244}$$

$$(ii) n = 240 \quad P(\text{neither}) = 0.25$$

$$\therefore p = 0.25 \quad q = 0.75$$

$$X \sim B(240, 0.25)$$

$$P(X < 50) = ?$$

$$\mu = np = 60 \quad \text{ } \quad \sigma^2 = npq = 45$$

∴ NORMAL APPX FOR X:

$$X \sim N(60, 45)$$

$$\therefore P(X < 50) = \underbrace{P(X < 49.5)}_{\text{BETTER APPX}}$$

$$Z = \frac{49.5 - 60}{\sqrt{45}} = -1.565$$

$$\begin{aligned}\therefore P(Z < -1.565) &= 1 - \Phi(1.565) \\ &= 1 - 0.9412\end{aligned}$$

$$\therefore \boxed{P(X < 50) = 0.0588}$$

$$\textcircled{9} \quad p(\text{bike}) = 0.65$$

$$(i) \quad n=15 \quad p=0.65 \quad q=0.35 \quad X = \# \text{ of children that own bikes.}$$

$$\begin{aligned} P(X > 12) &= P(X=13) + P(X=14) + P(X=15) \\ &= \binom{15}{13} (0.65)^{13} (0.35)^2 + \\ &\quad \binom{15}{14} (0.65)^{14} (0.35) + \\ &\quad \binom{15}{15} (0.65)^{15} (0.35)^0 \end{aligned}$$

$$\therefore \boxed{P(X > 12) = 0.0617}$$

$$(ii) \quad n=250 \quad p=0.65 \quad q=0.35$$

$$X \sim B(250, 0.65)$$

$$P(X < 179) = ?$$

$$\mu = np = 162.5 \quad \sigma^2 = npq = 56.875$$

$\therefore$ NORMAL APRX FOR X :

$$X \sim N(162.5, 56.875)$$

$$P(X < 179) = P(X < 178.5)$$

$$\therefore Z = \frac{178.5 - 162.5}{\sqrt{56.875}} = 2.122$$

$$P(Z < 2.122) = \Phi(2.122) \\ = 0.983$$

$$\therefore \boxed{P(X < 179) = 0.983}$$

$$(10) \quad p(\text{satisfied}) = 0.66$$

$$(i) \quad n=10 \quad X = \# \text{ of houses satisfied with speed}$$

$$p = 0.66$$

$$q = 0.34$$

$$\begin{aligned} P(X \geq 8) &= P(X=8) + P(X=9) + P(X=10) \\ &= \binom{10}{8} (0.66)^8 (0.34)^2 + \\ &\quad \binom{10}{9} (0.66)^9 (0.34) + \\ &\quad (0.66)^{10} \end{aligned}$$

$$\boxed{P(X \geq 8) = 0.284}$$

$$(ii) \quad n=150 \quad p=0.66 \quad q=0.34$$

$$X \sim B(150, 0.66)$$

$$P(X > 84) = ?$$

$$\mu = np = 99$$

$$\sigma^2 = npq = 33.66$$

NORMAL APPROX FOR X :

$$X \sim N(99, 33.66)$$

$$P(X > 84) = \underbrace{P(X > 84.5)}_{\text{BETTER APPROX}}$$

$$\therefore Z = \frac{84.5 - 99}{\sqrt{33.66}} = -2.499$$

$$\begin{aligned} P(Z > -2.499) &= P(Z < 2.499) \\ &= \Phi(2.499) \\ &= 0.994 \end{aligned}$$

$$\boxed{P(X > 84) = 0.944}$$

$$(11) \quad p(\text{swimming}) = 1/3 \quad n = 270$$

$$\therefore p = 1/3 \quad q = 2/3 \quad X = \begin{array}{l} \text{\# of days} \\ \text{George goes} \\ \text{swimming} \end{array}$$

$$X \sim B(270, 1/3)$$

$$P(X \geq 100) = ?$$

$$\mu = np = 90 \quad \sigma^2 = npq = 60$$

NORMAL APPROX FOR X:

$$X \sim N(90, 60)$$

$$P(X \geq 100) = \underbrace{P(X > 99.5)}_{\text{Better approx.}}$$

$$\therefore Z = \frac{99.5 - 90}{\sqrt{60}} = 1.226$$

$$\begin{aligned} P(Z > 1.226) &= 1 - P(Z < 1.226) \\ &= 1 - \Phi(1.226) \end{aligned}$$

$$\therefore \boxed{P(X \geq 100) = 0.110}$$

$$\textcircled{12} P(\text{backpack}) = 0.65$$

x = # of passengers carrying a back pack.

$$n = 12 \quad p = 0.65 \quad q = 0.35$$

$$\begin{aligned} P(x = 7) &= \binom{12}{7} (0.65)^7 (0.35)^5 \\ &= 0.2039 \end{aligned}$$

$$\boxed{P(x = 7) = 0.2039}$$

$\therefore$ Probability of success is the probability that a full mini bus contains 7 people carrying a back pack.

$$\therefore p = P(x = 7) = 0.2039$$

$$\therefore q = 0.7961$$

$$\text{For } n = 250$$

$$p = 0.2039$$

$$q = 0.7961$$

$$\therefore X \sim B(250, 0.2039) \quad \text{where:}$$

$X = \#$ of
full minibuses
that have
7 people with
backpack.

$$P(X > 54) = ?$$

$$\mu = np = 50.9798$$

$$\sigma^2 = npq = 40.5851$$

$\therefore$ NORMAL APPROX FOR X :

$$X \sim N(50.9798, 40.5851)$$

$$P(X > 54) = \underbrace{P(X > 54.5)}_{\text{BETTER APPROX}}$$

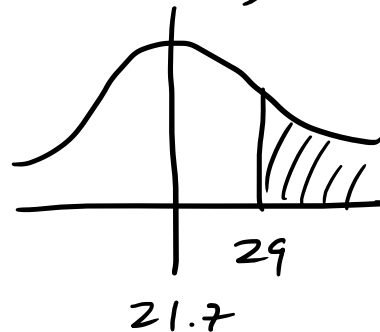
$$\begin{aligned} \therefore Z &= \frac{54.5 - 50.9798}{\sqrt{40.5851}} \\ &= 0.5526 \end{aligned}$$

$$\begin{aligned}
 P(Z > 0.5526) &= 1 - \Phi(0.5526) \\
 &= 1 - 0.7098 \\
 &= 0.290
 \end{aligned}$$

$$\therefore \boxed{P(X > 54) = 0.290}$$

⑬ $X \sim N(21.7, 6.5^2)$ $X = \text{Book heights}$
 $P(\text{Large}) = P(X > 29)$

$$P(X > 29) = ?$$



$$Z = \frac{29 - 21.7}{6.5} = 1.123$$

$$\begin{aligned}
 \therefore P(X > 29) &= P(Z > 1.123) \\
 &= 1 - P(Z < 1.123) \\
 &= 1 - \Phi(1.123) \\
 &= 1 - 0.8692
 \end{aligned}$$

$$\boxed{P(\text{LARGE}) = 0.1308}$$

$$\therefore n = 8 \quad p = P(\text{LARGE}) = 0.1308$$

$$q = 0.8692$$

$Y = \#$ of randomly chosen books that are large.

$$\begin{aligned} P(Y < 2) &= P(Y=0) + P(Y=1) \\ &= \binom{8}{0} (0.1308)^0 (0.8692)^8 + \\ &\quad \binom{8}{1} (0.1308)^1 (0.8692)^7 \end{aligned}$$

$$\therefore \boxed{P(Y < 2) = 0.718}$$

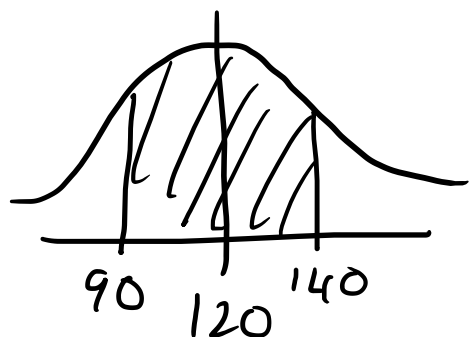
$$(14) \quad X \sim N(120, 24^2)$$

Small : $X < 90$

medium : $90 < X < 140$

LARGE : $X > 140$

$$(i) \quad P(90 < X < 140) = ?$$



$$z_1 = \frac{90 - 120}{24} = -1.25$$

$$z_2 = \frac{140 - 120}{24} = 0.833$$

$$\therefore P(90 < X < 140) = P(-1.25 < Z < 0.833)$$

$$\begin{aligned} P(-1.25 < Z < 0.833) &= P(Z < 0.833) - P(Z < -1.25) \\ &= \Phi(0.833) - (1 - \Phi(1.25)) \\ &= 0.7975 - (1 - 0.8944) \\ &= 0.692 \end{aligned}$$

$$\therefore \boxed{P(90 < X < 140) = 0.692}$$

$$(ii) \quad p(\text{success}) = p(90 < x < 140) = 0.692$$

$$\therefore p = 0.692$$

$$q = 0.308$$

$$n = 4$$

$Y = \#$ of apples
graded medium.

$$P(Y \geq 2) = P(Y=2) + P(Y=3) + P(Y=4)$$

$$= \binom{4}{2} (0.692)^2 (0.308)^2 +$$

$$\binom{4}{3} (0.692)^3 (0.308) +$$

$$(0.692)^4$$

$$= 0.910$$

$$\therefore \boxed{P(Y \geq 2) = 0.910}$$